Small Business Innovation Research/Small Business Tech Transfer

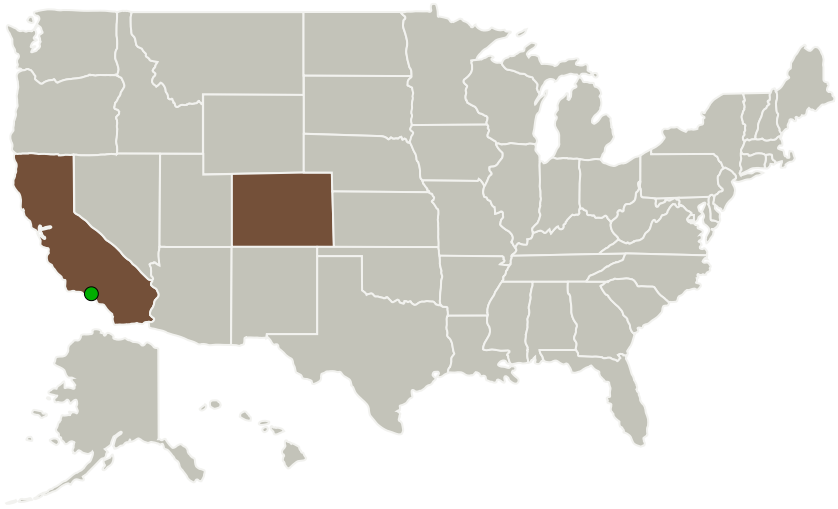
Thermopile Area Array Readout, Phase II

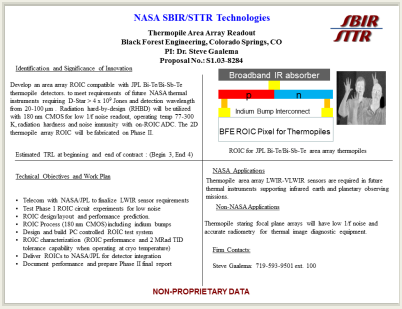
Completed Technology Project (2014 - 2016)

Project Introduction

NASA/JPL thermopile detector linear arrays, wire bonded to Black Forest Engineering (BFE) CMOS readout integrated circuits (ROICs), have been utilized in NASA missions such as the Mars Climate Sounder (MCS) and the Diviner Lunar Radiometer Experiment (DLRE). JPL linear array thermopile detectors are fabricated by bulk micro-machining. Micro-machined thermopiles bump bonded to a ROIC are desirable for area (2-D) focal plane arrays (FPAs) because the architecture provides both high detector fill factor and circuit fill factor in the pixel. The proposed innovation is to develop an area array ROIC compatible with bump bondable micro-machined thermopile detectors. The ROIC will be compatible with JPL Bi-Te/Bi-Sb-Te micro-machined thermopile detector arrays to meet requirements of future NASA thermal instruments requiring D-Star > 4 x 109 Jones. Radiation hard-by-design (RHBD) will be utilized with 180 nm CMOS for low 1/f noise readout, operating temp 77-300 K, radiation hardness and noise immunity with on-ROIC ADC. A small pixel pitch and binning is utilized to cover a desired wavelength detection range of 20µm – 100 µm. The Phase I ROIC array design will be fabricated on Phase II.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Black Forest Engineering, LLC	Lead Organization	Industry	Colorado Springs, Colorado
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Colorado

Project Transitions

April 2014: Project Start

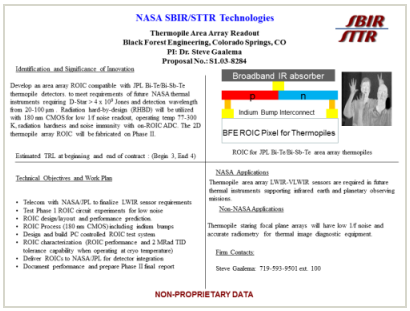
April 2016: Closed out

Closeout Summary: Thermopile Area Array Readout, Phase II Project Image

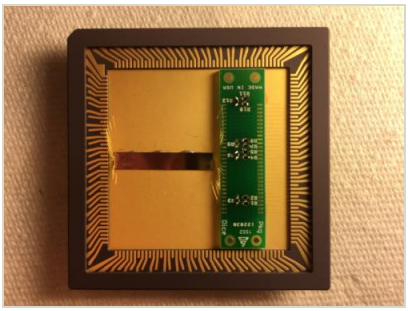
Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/140713)*

Images



Briefing Chart Image
Thermopile Area Array Readout, Phase II *(https://techport.nasa.gov/image/134406)*



Final Summary Chart Image
Thermopile Area Array Readout, Phase II Project Image *(https://techport.nasa.gov/image/134769)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Black Forest Engineering, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

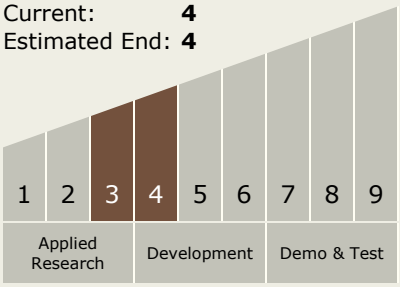
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Stephen Gaalema

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System